# Environmental Product Declaration

## In accordance with EN 15804+A2 & ISO 14025 / ISO 21930

## Manufactured LimeStone (M-LS)

## O.C.O Technology Ltd

| Programme: | Programme operator: | EPD registration number: | Publication date: | Valid until: |
|---|---|---|---|---|
| The International EPD® System, www.environdec.com | EPD International AB | S-P-04739 | 2021-10-20 | 2026-10-15 |

*An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at www.environdec.com.*

# GENERAL INFORMATION

## MANUFACTURER INFORMATION

| | |
|---|---|
| **Manufacturer** | O.C.O Technology Ltd |
| **Address** | Norfolk House, High Street, Brandon, Suffolk, IP27 0AX |
| **Contact details** | info@oco.co.uk |
| **Website** | www.oco.co.uk |

## PRODUCT IDENTIFICATION

| | |
|---|---|
| **Product name** | Manufactured LimeStone (M-LS) |
| **Place(s) of production** | Brandon, Avonmouth and Leeds |
| **CPC code** | 15320 Pebbles, gravel, broken or crushed stone, macadam; granules, chippings and powder of stone |

**The International EPD System**

*EPDs within the same product category but from different programmes may not be comparable.*

## EPD INFORMATION

The EPD owner has the sole ownership, liability, and responsibility for the EPD. Construction products EPDs may not be comparable if they do not comply with EN 15804 and if they are not compared in a building context.

| | |
|---|---|
| **EPD program operator** | The International EPD System |
| **EPD standards** | This EPD is in accordance with EN 15804+A2 and ISO 14025 standards. |
| **Product category rules** | The CEN standard EN 15804+A2 serves as the core PCR. PCR 2019:14, the construction product PCR based on EN 15804:A2, The International EPD System is used. |
| **EPD author** | Matthew Butcher, British Precast |
| **EPD verification** | Independent verification of this EPD and data, according to ISO 14025:<br>☐ Internal certification ☑ External verification |
| **Verification date** | 16/10/2021 |
| **EPD verifier** | Bárbara M. Civit |
| **EPD number** | S-P-04739 |
| **Publishing date** | 20/10/2021 |
| **EPD valid until** | 15/10/2026 |

# PRODUCT INFORMATION

## PRODUCT DESCRIPTION

Manufactured LimeStone (M-LS) is an artificial rock composed of accelerated carbonation stabilised thermal residue, sand, and cement.

## PRODUCT APPLICATION

Masonry units, concrete, asphalt, hydraulically bound mixtures, unbound mixtures.

## TECHNICAL SPECIFICATIONS

Typical density 1100±100kg/$m^3$. Compressive strength >5N/$mm^2$

## PRODUCT STANDARDS

BS EN 13055-1 Lightweight aggregates - Lightweight aggregates for concrete, mortar and grout,

BS EN 13242 Aggregates for unbound and hydraulically bound materials for use in civil engineering work and road construction

## PHYSICAL PROPERTIES OF THE PRODUCT

Grey rounded stone-like pellets.

## ADDITIONAL TECHNICAL INFORMATION

Further information can be found at www.oco.co.uk.

## PRODUCT RAW MATERIAL COMPOSITION

**Table 1. Product composition**

| Product and Packaging Material | Weight, kg | Post-consumer % | Renewable % | Country Region of origin |
|---|---|---|---|---|
| Thermal Residue Mixture | 294-497 | 100 | 0 | UK |
| Binder Mixture | 64-109 | 0 | 0 | UK |
| Filler Mixture | 190-381 | 38 | 0 | UK |
| Liquid $CO_2$ | 53-201 | 7 | 93 | UK |
| Water | 86-187 | 20 | 0 | UK |

## SUBSTANCES, REACH - VERY HIGH CONCERN

The product does not contain any REACH SVHC substances in amounts greater than 0,1 % (1000 ppm).

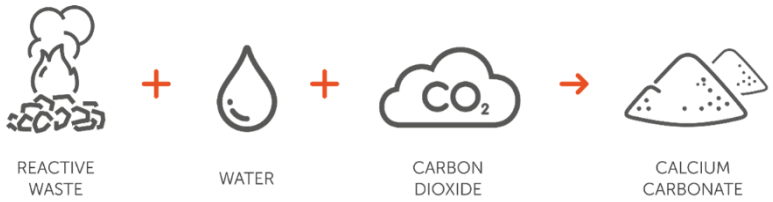
# PRODUCT LIFE-CYCLE

## MANUFACTURING AND PACKAGING (A1-A3)

This EPD covers the cradle to gate scope with following modules; A1 (Raw material supply), A2 (Transport) and A3 (Manufacturing).

M-LS (Manufactured LimeStone) is artificial rock manufactured by reacting carbon dioxide with industrial process residues. Many wastes react naturally with carbon dioxide. If the conditions are carefully controlled, this natural reaction can be accelerated, taking place in minutes rather than months or years. This results in the formation of calcium carbonate (limestone). The primary reaction is represented in figure 1.

Figure 1: Basic accelerated carbonation reaction




The process is a genuine Carbon Capture and Utilisation (CCU) process. During the process, significant volumes of carbon dioxide are permanently captured as stable carbonates. The process has further benefit in the valorisation of thermal wastes as construction products. At the three commercial facilities operated by O.C.O in the UK, carbonated thermal wastes are blended with binders and fillers and then pelletised to form a rounded aggregate (M-LS or Manufactured-LimeStone) that has many applications in construction.

The finished M-LS has captured more carbon dioxide than is emitted in its manufacture, resulting in the World's first carbon negative aggregate. A typical M-LS sample is shown in figure 2.

Figure 2. Typical M-LS sample

M-LS is manufactured using a multiple stage process designed to stabilise and valorise industrial thermal residues as a useful construction product (see figure 3). Thermal residue arriving on site is stored in silos before being blended with material from other sources. The blended residue passes through a mixing stage where $CO_2$ and water are added to achieve chemical stabilisation. The resulting calcium carbonate (CaCO3) mixture undergoes a second mixing stage where additional reagents are added. Finally, the combined mixture undergoes pelletising to form the rounded product. Further $CO_2$ naturally combines with the product whilst it

undergoes curing and storage on site. The technology is adaptable to a wide variety of thermal residues including those arising from biomass, energy from waste, cement manufacture, steel and aluminium production, paper manufacture, and wastewater treatment.
The reaction promotes rapid solidification and improved mechanical properties and modification of contaminant mobility (see figure 3). Carbonation results in a reduction in porosity due to the formation of voluminous calcium carbonate in the pore space. This aids the retention of contaminants through improved physical containment. Crystals of calcium carbonate join together in an interlocking lattice, forming an unimpaired bond between grains.
Figure 3: Solidification Process


The carbonation reaction results in chemical stabilisation which improves contaminant retention. Under optimum conditions the rate of heavy metal release can be reduced by up to several orders of magnitude. This is due to precipitation of metals as low solubility carbonates, the formation of solid solutions in the precipitated calcium carbonate, and sorption onto crystal surfaces.

## TRANSPORT AND INSTALLATION (A4-A5)

Transportation impacts occurred from final products delivery to construction site (A4) cover fuel direct exhaust emissions, environmental impacts of fuel production, as well as related infrastructure emissions.

This EPD does not cover modules A4-A5.

## PRODUCT USE AND MAINTENANCE (B1-B7)

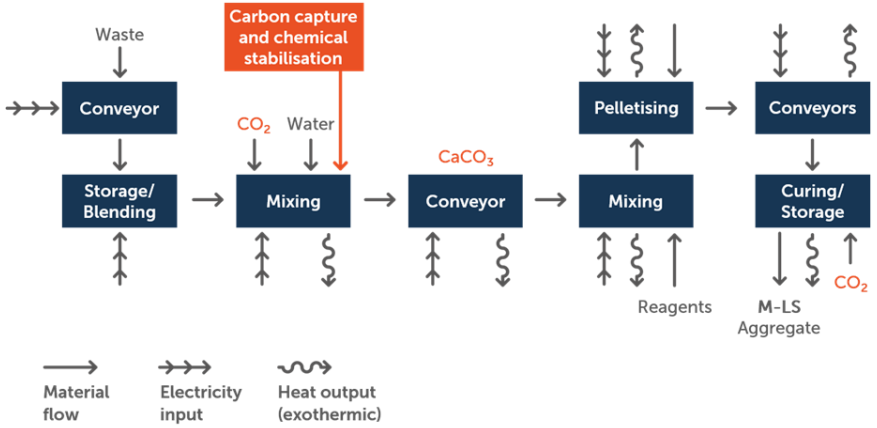
This EPD does not cover the use phase. Air, soil and water impacts during the use phase have not been studied.

## PRODUCT END OF LIFE (C1-C4, D)

This EPD does not cover modules C1-C4 or D. M-LS is never used alone in any application; it is always physically integrated with other materials (such as virgin and recycled aggregate and cement), meaning that they cannot be physically separated nor specifically identified at end of life. It is non-organic and therefore does not include biogenic carbon in biomass.

# MANUFACTURING PROCESS

Figure 4: Manufacturing process



# LIFE-CYCLE ASSESSMENT

## LIFE-CYCLE ASSESSMENT INFORMATION

| | |
|---|---|
| **Period for data** | 2019/2020 |

## DECLARED AND FUNCTIONAL UNIT

| | |
|---|---|
| **Declared unit** | 1 tonne |
| **Mass per declared unit** | 1000kg |
| **Reference service life** | 100 years |

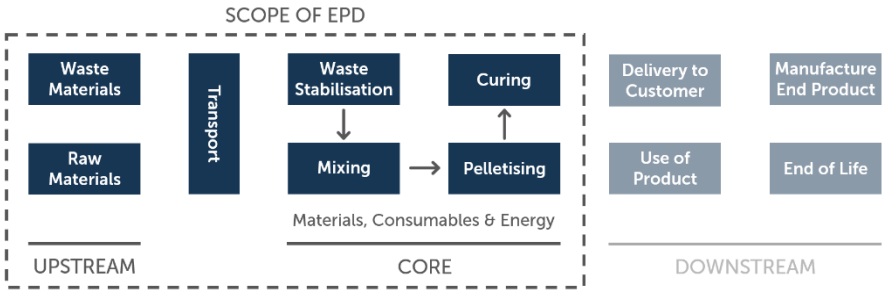
## SYSTEM BOUNDARY

This EPD covers the *cradle to gate* scope with following modules; A1 (Raw material supply), A2 (Transport) and A3 (Manufacturing).

| Product stage | | | Assembly stage | | Use stage | | | | | | | End of life stage | | | | Beyond the system boundaries | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A1 | A2 | A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D | D | D |
| x | x | x | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND |
| **Geography**, by two-letter ISO country code or regions. The International EPD System only. | | | | | | | | | | | | | | | | | | |
| EU | EU | EU | - | - | - | - | - | - | - | - | - | - | - | - | - | - | | |
| Raw materials | Transport | Manufacturing | Transport | Assembly | Use | Maintenance | Repair | Replacement | Refurbishment | Operational energy use | Operational water use | Deconstr./demol. | Transport | Waste processing | Disposal | Reuse | Recovery | Recycling |

*Modules not declared = MND. Modules not relevant = MNR.*

Figure 5: System Boundary




## CUT-OFF CRITERIA

The study does not exclude any modules or processes which are stated mandatory in the EN 15804:2012+A2:2019 and the applied PCR. The study does not exclude any hazardous materials or substances.

The study includes all major raw material and energy consumption. All inputs and outputs of the unit processes, for which data is available for, are included in the calculation. There is no neglected unit process more than 1% of total mass or energy flows. The module specific total neglected input and output flows also do not exceed 5% of energy usage or mass.

The study only reports on modules A1-A3, mirroring exemption criteria set out in EN 15804:2012+A2:2019 for products which cannot be separated out at the end of life from downstream products.
The study includes all major raw material and energy consumption. All inputs and outputs of the unit processes which data are available for are included in the calculation. There is no neglected unit process more than 1% of total mass and energy flows. The total neglected input and output flows do also not exceed 5% of energy usage or

mass. The life cycle analysis includes all industrial processes from raw material acquisition to production.
For easier modelling and because of lack of accuracy in available modelling resources many constituents under 0,1% of product mass are excluded. These include admixtures which are all present in the product only in very small amounts and have no serious impact on the emissions of the product.
The production of capital equipment, maintenance and operation of capital equipment, personnel-related activities, energy and water use related to company management and sales activities are excluded.

## ALLOCATION, ESTIMATES AND ASSUMPTIONS

Allocation is required if some material, energy, and waste data cannot be measured separately for the product under investigation.

In this study, as per EN 15804, allocation is conducted in the following order:

1. Allocation should be avoided.
2. Allocation should be based on physical properties (e.g. mass, volume) when the difference in revenue is small.

3. Allocation should be based on economic values.

This LCA study is conducted in accordance with all methodological considerations, such as performance, system boundaries, data quality, allocation procedures, and decision rules to evaluate inputs and outputs. All estimations and assumptions are given below:
• Module A2: Vehicle capacity utilisation volume factor is assumed to be 1 which means full load. In reality, it may vary but as the role of transportation emission in the total results is small, the variety in load is assumed to be negligible. Empty returns are not taken into account as it is assumed that a return trip is used by the transportation company to serve the needs of other clients.
Defra figures used for the transportation of factory waste to landfill/recycling.
(https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2020Reference).
• Module A3:
The manufacturing process of M-LS utilises Accelerated Carbonation Technology to start a carbonation process in which carbon dioxide is captured and permanently fixed in the product. This process is an intrinsic part of the manufacturing process, taking place much faster than it would do naturally and continuing whilst the product is in stockpiles prior to use by O.C.O customers in the manufacture of blocks and blended aggregate. The extent of carbonation that can take place with the particular blend of materials used is identified by stoichiometric analysis. To ensure that carbonation has been considered completely and fully accounted for in this EPD, it is based on the assumption that all carbonation takes place during the module A3 manufacturing phase.

Carbonation is determined by a stoichiometric calculation using the chemical composition of the raw materials acting as $CO_2$ sinks (thermal residues and cement). The composition is determined by X-Ray Fluorescence (XRF) to obtain the proportions of participating elements (calcium, sodium, potassium, and sulfur). An equation developed by Steinour (Steinour, H.H. 1959. Some effects of carbon dioxide on mortars and concrete: a discussion. J. Amer. Concrete Inst. 30, 905-907) is applied to calculate the total carbon

capacity of the raw materials. A correction factor is applied to act as buffer for incomplete carbonation of the materials (Gunning, P.J., Hills, C.D. and Carey, P.J. (2010). Accelerated carbonation treatment of industrial wastes. Waste Management, 30, 1081–1090). The method has previously been used and verified for PAS2050 carbonation calculation purposes.

The chemical reaction that takes place during the formation of the aggregate is exothermic and there will be a direct heat emission to the atmosphere. The direct heat emission is estimated to be 9.33 kWh per tonne. This emission is not included in the EPD indicator results.
As part of the chemical reaction a small amount of ammonia gas will also be released to the atmosphere. Ammonia release is less than 4e-6%, which is four orders of magnitude below the minimum reporting threshold of 0.1%.

Allocation used in Ecoinvent 3.6 environmental data sources follows the methodology 'allocation, cut-off by classification'. This methodology is in line with the requirements of the EN 15804 - standard.

## AVERAGES AND VARIABILITY

### The International EPD System additional data requirements

Data specificity and GWP-GHG variability for GWP-GHG for A1-A3.

| | |
|---|---|
| **Supply-chain specific data for GWP-GHG** | 90% |
| **Variation in GWP-GHG between products** | - |
| **Variation in GWP-GHG between sites** | See Below |

The basic raw material (APCr) varies through time from each supplier and between different suppliers, therefore the recipe mix has to be adjusted on an ongoing basis at all sites as part of the quality control process. This results in the ranges of input material seen in the product raw material composition table. These varied inputs will have related impacts on the GWP of the final product. This EPD has been calculated from the production volumes across all three sites over a 12-month period and reports an accurate average over that period.

# ENVIRONMENTAL IMPACT DATA

Note: additional environmental impact data may be presented in annexes.

## CORE ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, PEF

| Impact category | Unit | A1 | A2 | A3 | A1-A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GWP – total | kg $CO_2e$ | 1.02E2 | 5.2E0 | -1.4E2 | -3.32E1 | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND |
| GWP – fossil | kg $CO_2e$ | 1E2 | 5.2E0 | -1.4E2 | -3.47E1 | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND |
| GWP – biogenic | kg $CO_2e$ | 1.51E0 | 3.32E-3 | 1.54E-3 | 1.52E0 | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND |
| GWP – LULUC | kg $CO_2e$ | 2.01E-2 | 1.68E-3 | 2.86E-3 | 2.46E-2 | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND |
| Ozone depletion pot. | kg $CFC_{-11}e$ | 3.61E-6 | 1.2E-6 | 4.38E-7 | 5.24E-6 | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND |
| Acidification potential | mol H+e | 2.52E-1 | 2.15E-2 | 2.17E-2 | 2.95E-1 | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND |
| EP-freshwater[2)] | kg Pe | 1.37E-3 | 4.51E-5 | 6.72E-5 | 1.49E-3 | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND |
| EP-marine | kg Ne | 6.53E-2 | 6.34E-3 | 7.75E-3 | 7.94E-2 | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND |
| EP-terrestrial | mol Ne | 7.61E-1 | 7.01E-2 | 8.61E-2 | 9.17E-1 | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND |
| POCP (“smog”) | kg NMVOCe | 1.92E-1 | 2.24E-2 | 2.24E-2 | 2.37E-1 | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND |
| ADP-minerals & metals | kg Sbe | 5.52E-4 | 1.02E-4 | 6.16E-6 | 6.6E-4 | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND |
| ADP-fossil resources | MJ | 4.47E2 | 7.98E1 | 6.66E1 | 5.93E2 | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND |
| Water use[1)] | $m^3e$ depr. | 1.04E1 | 3.05E-1 | 7.26E-2 | 1.07E1 | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND |

1) GWP = Global Warming Potential; EP = Eutrophication potential; POCP = Photochemical ozone formation; ADP = Abiotic depletion potential. 2) EN 15804+A2 disclaimer for Abiotic depletion and Water use and optional indicators except Particulate matter and Ionizing radiation, human health. The results of these environmental impact indicators shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator. 3) Required characterisation method and data are in kg P-eq. Multiply by 3,07 to get PO4e.

## USE OF NATURAL RESOURCES

| Impact category | Unit | A1 | A2 | A3 | A1-A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Renew. PER as energy | MJ | 3.21E1 | 9.86E-1 | 8.74E0 | 4.18E1 | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND |
| Renew. PER as material | MJ | 0E0 | 0E0 | 0E0 | 0E0 | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND |
| Total use of renew. PER | MJ | 3.21E1 | 9.86E-1 | 8.74E0 | 4.18E1 | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND |

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Non-re. PER as energy | MJ | 4.47E2 | 7.98E1 | 6.66E1 | 5.93E2 | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND |
| Non-re. PER as material | MJ | 0E0 | 0E0 | 0E0 | 0E0 | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND |
| Total use of non-re. PER | MJ | 4.47E2 | 7.98E1 | 6.66E1 | 5.93E2 | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND |
| Secondary materials | kg | 4.2E2 | 0E0 | 0E0 | 4.2E2 | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND |
| Renew. secondary fuels | MJ | 0E0 | 0E0 | 0E0 | 0E0 | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND |
| Non-ren. secondary fuels | MJ | 0E0 | 0E0 | 0E0 | 0E0 | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND |
| Use of net fresh water | $m^3$ | 1.96E0 | 1.61E-2 | 1.37E-2 | 1.99E0 | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND |

6) PER = Primary energy resources

## END OF LIFE – WASTE

| Impact category | Unit | A1 | A2 | A3 | A1-A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hazardous waste | Kg | 1.73E0 | 8.54E-2 | 1.57E-1 | 1.98E0 | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND |
| Non-hazardous waste | Kg | 6.07E1 | 8.05E0 | 2.27E0 | 7.1E1 | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND |
| Radioactive waste | Kg | 2.2E-3 | 5.42E-4 | 5.09E-4 | 3.25E-3 | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND |

## END OF LIFE – OUTPUT FLOWS

| Impact category | Unit | A1 | A2 | A3 | A1-A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Components for re-use | Kg | 0E0 | 0E0 | 0E0 | 0E0 | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND |
| Materials for recycling | Kg | 0E0 | 0E0 | 0E0 | 0E0 | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND |
| Materials for energy rec | Kg | 0E0 | 0E0 | 0E0 | 0E0 | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND |
| Exported energy | MJ | 0E0 | 0E0 | 0E0 | 0E0 | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND |

## ENVIRONMENTAL IMPACTS – GWP-GHG - THE INTERNATIONAL EPD SYSTEM

| Impact category | Unit | A1 | A2 | A3 | A1-A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GWP-GHG | kg $CO_2e$ | 1E2 | 5.2E0 | -1.4E2 | -3.47E1 | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND |

8) This indicator includes all greenhouse gases excluding biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product as defined by IPCC AR 5 (IPCC 2013) This indicator Is almost equal to the GWP indicator originally defined in EN 15804:2012+A1:2013.

## SCENARIO DOCUMENTATION

Manufacturing energy scenario documentation

| Scenario parameter | Value |
|---|---|
| Electricity data source and quality | Electricity, high voltage, production mix (Reference product: electricity, high voltage), Finland, Ecoinvent 3.6, year: 2020 |
| Electricity kg $CO_2e$ / kWh | 0.24 |
| District heating data source and quality | Heat and power co-generation, natural gas, conventional power plant, 100mw electrical (Reference product: heat, district or industrial, natural gas), Finland, Ecoinvent 3.6, year: 2020 |
| District heating kg $CO_2e$ / kWh | 0.11 |

## BIBLIOGRAPHY


ISO 14025:2010 Environmental labels and declarations – Type III environmental declarations. Principles and procedures.

ISO 14040:2006 Environmental management. Life cycle assessment. Principles and frameworks.

ISO 14044:2006 Environmental management. Life cycle assessment. Requirements and guidelines.

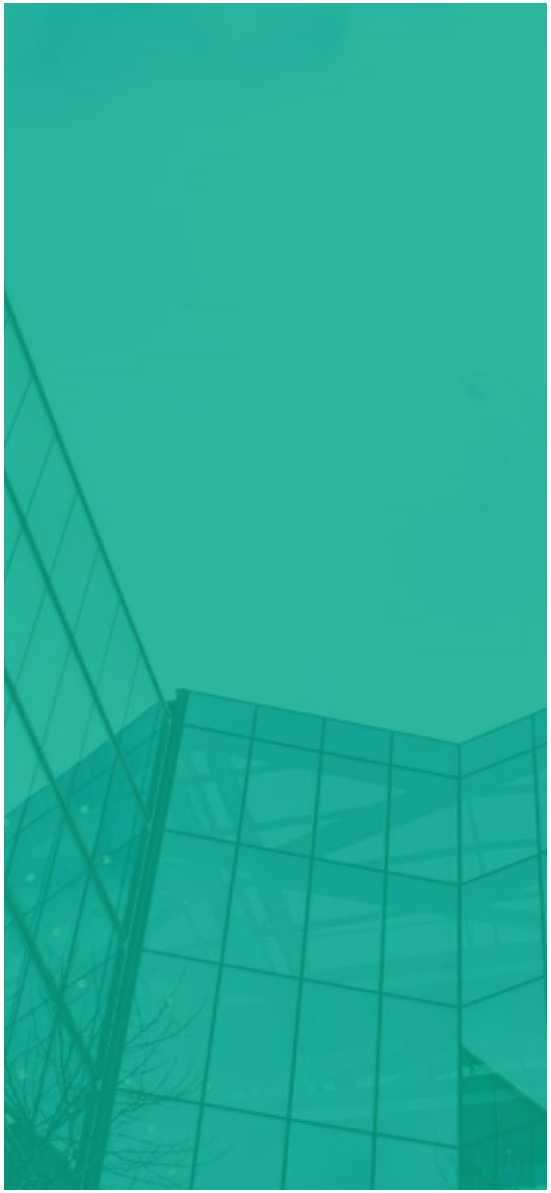
Ecoinvent database v3.6 (2019) and One Click LCA database.

EN 15804:2012+A2:2019 Sustainability in construction works – Environmental product declarations – Core rules for the product category of construction products.

The CEN standard EN 15804+A2 serves as the core PCR. PCR 2019:14, the construction product PCR based on EN 15804:A2, The International EPD System

EPD. General Programme Instructions of the international EPD® system. Version 4.0

Manufactured LimeStone (M-LS) LCA background report 10.08.2021



## ABOUT THE MANUFACTURER

O.C.O Technology has developed a Carbon Capture and Utilisation (CCU) process to treat and stabilise thermal residues, and in turn valorise them into sustainable construction products such as carbon negative aggregate. With the unique use of carbon dioxide within its treatment process, O.C.O is amongst the top companies in the world for permanent carbon capture in a commercialised process. It is also believed to be the only company in the World that produces an aggregate that is truly carbon negative. O.C.O Technology is a genuine 'World's First', on many fronts and has attracted interest from both the UK Government and the international community.

## EPD AUTHOR AND CONTRIBUTORS

| | |
|---|---|
| **Manufacturer** | O.C.O Technology Ltd |
| **EPD author** | Matthew Butcher, British Precast |
| **EPD verifier** | Bárbara M. Civit |
| **EPD program operator** | The International EPD System |
| **Background data** | This EPD is based on Ecoinvent 3.6 (cut-off) and One Click LCA databases. |
| **LCA software** | The LCA and EPD have been created using One Click LCA Pre-Verified EPD Generator for Cementitious Products |

# VERIFICATION STATEMENT

## VERIFICATION PROCESS FOR THIS EPD

This EPD has been verified in accordance with ISO 14025 by an independent, third-party verifier by reviewing results, documents and compliance with EN 15804, ISO 14025 and ISO 14040/14044, following the process and checklists of the program operator for:

- This Environmental Product Declaration
- The Life-Cycle Assessment used in this EPD
- The background report (project report) for this EPD

Why does verification transparency matter? Read more online.

## VERIFICATION OVERVIEW

Following independent third party has verified this specific EPD:

| EPD verification information | Answer |
|---|---|
| Third-party verifier for EPD | Bárbara M. Civit |
| EPD verification started on | 30/09/2021 |
| EPD verification completed on | 16/10/2021 |
| Supply-chain specific data % | 90 % of A1-A3 GWP-GHG/fossil |
| Approver of the EPD verifier | The International EPD System |

| Author & tool verification | Answer |
|---|---|
| EPD author | British Precast |
| EPD author training completion | 25.3.2021 |
| EPD Generator module | Cementitious Products |
| Independent software verifier | Ugo Pretato, Studio Fieschi & soci Srl. |
| Software verification date | 11.5.2021 |

## THIRD-PARTY VERIFICATION STATEMENT

I hereby confirm that, following detailed examination, I have not established any relevant deviations by the studied Environmental Product Declaration (EPD), its LCA and project report, in terms of

- the data collected and used in the LCA calculations,
- the way the LCA-based calculations have been carried out,
- the presentation of environmental data in the EPD, and
- other additional environmental information, as present

with respect to the procedural and methodological requirements in ISO 14025:2010 and EN 15804:2012+A2:2019.

I confirm that the company-specific data has been examined as regards plausibility and consistency; the declaration owner is responsible for its factual integrity and legal compliance.

I confirm that I have sufficient knowledge and experience of construction products, this specific product category, the construction industry, relevant standards, and the geographical area of the EPD to carry out this verification.

I confirm my independence in my role as verifier; I have not been involved in the execution of the LCA or in the development of the declaration and have no conflicts of interest regarding this verification.

Bárbara M. Civit

# VERIFICATION AND REGISTRATION (ENVIRONDEC)

| ISO standard ISO 21930 and CEN standard EN 15804 serves as the core Product Category Rules (PCR) | |
|---|---|
| PCR | PCR 2019:14 Construction products, version 1.11 |
| PCR review was conducted by: | The Technical Committee of the International EPD® System. See www.environdec.com/TC for a list of members. Review chair: Claudia A. Peña, University of Concepción, Chile. The review panel may be contacted via the Secretariat www.environdec.com/contact. |
| Independent third-party verification of the declaration and data, according to ISO 14025:2006: | Independent verification of this EPD and data, according to ISO 14025:<br>☐ Internal certification ☑ External verification |
| Third party verifier | Bárbara M. Civit |
| | Approved by: The International EPD® System Technical Committee, supported by the Secretariat |
| Procedure for follow-up during EPD validity involves third party verifier | yes ☐ no |

THE INTERNATIONAL EPD® SYSTEM

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# ANNEX 1 : ENVIRONMENTAL IMPACTS – EN 15804+A1, CML / ISO 21930

| Impact category | Unit | A1 | A2 | A3 | A1-A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Global Warming Pot. | kg $CO_2e$ | 9.81E1 | 5.15E0 | -1.4E2 | -3.69E1 | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND |
| Ozone depletion Pot. | kg $CFC_{-11}e$ | 3.09E-6 | 9.51E-7 | 4.24E-7 | 4.46E-6 | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND |
| Acidification | kg $SO_2e$ | 1.86E-1 | 1.21E-2 | 1.64E-2 | 2.14E-1 | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND |
| Eutrophication | kg $(PO_4)^3e$ | 6.02E-2 | 2.56E-3 | 4.22E-3 | 6.7E-2 | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND |
| POCP (“smog”) | kg $C_2H_4$ | 7.53E-3 | 6.72E-4 | 5.66E-4 | 8.76E-3 | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND |
| ADP-elements | kg Sbe | 5.52E-4 | 1.02E-4 | 6.16E-6 | 6.6E-4 | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND |
| ADP-fossil | MJ | 4.47E2 | 7.98E1 | 6.66E1 | 5.93E2 | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND |